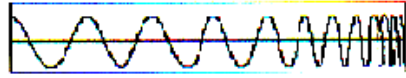


TAOSON



SIGNAL

Issue No. 4 December, 2008

TAOSON Director-- David Fields N4HBO
Newsletter Editor --Bill Seymour KM4YL

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I. Introduction

Welcome to the **Tamke-Allan Observatory Solar Observation Network**. **TAOSON** was conceived in 2007 and operated for its first year as a student group at TAO. In 2008 we opened up the group to the larger local amateur radio astronomy community.

The primary purpose of TAOSON is to keep local radio astronomers in touch and help coordinate their activities as they maintain their radio astronomy research sites. To this end we maintain a server for storing and sharing data, schedule meetings each month, and assist each other when needed. Most members support the Society of Amateur Radio Astronomers (see www.radio-astronomy.org).

Detailed information concerning TAOSON research capabilities and activities was published in the three inaugural issues of The Signal (September, October, November 2008). Due to size limitations, this information will no longer be included in the Signal. However, copies are available upon request and may be available on a TAOSON web site to be developed in the future.

Membership in TAOSON is free if you're actively doing radio astronomy. Otherwise, membership is still free and you are invited to help with our projects.

Our newsletter, the TAOSON Signal, will be published on or near the first day of each month. Every effort will be made to protect the e-mail addresses on the distribution list and the privacy of their owners. Feel free to circulate and share copies of the Signal.

Items for the newsletter will be submitted by e-mail to Editor Bill Seymour at swafseymo@bellsouth.net and to David Fields at fieldsde@aol.com not later than 10 days prior to the next publication date. We encourage each active member to submit a paragraph that summarizes site activities, goals, and ideas. Members are also invited to submit questions to the Editor to be considered in the newsletter and at meeting.

II. Meeting Announcements

TAOSON

Regular monthly meetings are held on the 2nd Sunday afternoon of the month. **Special meetings will be called as the need arises.**

Meeting format will usually include a brief tutorial on a radio astronomy topic of interest, a work session on some chosen task or topic, a meal or refreshments, and a brainstorming session about projects.

Area Optical Astronomy Groups

Oak Ridge Isochronous Observation Network (Orion) meets at 7:00 P.M. on the first Wednesday of each month The Club Room, Oak Ridge Civic Center. See www.roanestate.edu/obs and www.orioninc.org

Barnard Astronomical Society (BAS) meets at 7:00 P.M. on the second Thursday of each month at the UT Chattanooga Clarence Jones Observatory. See BAS@chattanooga.net.

Upcoming Events

Dec. 1 Save Roane Starry Skies and Tennessee Light Conservation meet at 6 P.M. at Earth Fare in Knoxville.

Dec. 3 ORION meets at 7 P.M. in Oak Ridge. Topics are
“Summer 2008 Eclipse Cruise” by Juan Carbaho
“How to Buy Your Christmas Telescope” by Lee Ericson
“Latest Local Research and Observing Activities” by David Fields and others
“Tennessee Light Conservation” by Liz Singley
Christmas Party Planning
Go to Shoney’s for Snack

Dec. 6 Public Stargaze at TAO—7 P.M.
Bring a dish to share. Topics are
“Variable Star Observing” by Heather Fries
“TAOSON Projects—Complex Antennas” by David Fields
Discussion: Several States Budget Crisis—What About Astronomy?
Chattanooga Barnard Astronomical Society Christmas Party—6 P.M.
St. Peter’s Episcopal Church; 848 Ashland Terrace

Dec. 13 Orion Christmas Picnic (TAOSON people invited)
Setup at TAO at 4 P.M. Bring a dish to share. The Party starts at 6 P.M.

Dec. 20 Public Stargaze at TAO at 7 P.M. Bring food to share.
Discussion of 2009 IYA. Night Sky Network activities.

Jan. 3 Public Stargaze at TAO at 7 P.M. Bring food to share.
Ham Class discussions. Monthly Constellation Program
Other topics.

Jan. 7 ORION meets in Oak Ridge

Jan 17 Ham Radio Class at TAO at 5 P.M.
Public Stargaze at TAO at 7 P.M. Bring a dish to share.

III. TAOSON Directory

TAOSON FACILITIES DIRECTORY

Site Location	Site Name	Code	Control Operator	Lat Long	Telephone	Operations
1 Rockwood	TAO	TAO	David Fields	35.8322 84.6175	865-376-1362	21 cm, 15m, optical, Ku, Spectracyber, Interferometer, IBT
2 Cleveland	SkyNet	SN	Bill & Melinda Lord	35.2427 84.8783	423-478-9043	21 cm, 15m, optical, Ku, Spectracyber, VLF (SID), FM Meteor, IBT
3 Solway	Solway	SOL	David Fields	35.9641 84.2021	865-927-5155	15m, Ku (2), optical, VLF, H-alpha
4 Hixson	Riverbend	RB	Dick Castle		423-870-4398	15m
5/7 Lenoir City	Lenoir City	LC	Aaron Haun		865-986-7153	Server, 15 m
6 Chattanooga	Big Ridge	BR	Bill Seymour		423-870-8552	15m, optical, Ku, VLF (SID), IBT
8 Knoxville	Blue Meadow	BLM	Linda Fippin		865-539-0826	VLF
9 Niota	Niota	CL	John Mannone		423-337-2197	Ku, Optical, VLF, IBT
10 Karns	Karns	KA	Carl Lyster			Spectracyber, VLF
11 Johnson City	Johnson City	JC	Heather Fries			Quantitative optical, VLF (SID) planned
Puerto Rico	Puerto Rico	PR	Wanda Diaz			15 m, Spectracyber
UNAM, MX	Mexico	UN	Stan Kurtz			15m, Spectracyber, Homebrew IBT, SRT

IV. Reports from The Sites

NIOTA

Based on the analysis of the SID data collected by the Lords at their SkyNet facility (Cleveland, TN) and its subsequent publication in SARA Journal*, I had received an invitation to corroborate with a Stanford solar research scientist, Dr. Bala Poduval, on looking at the global effect of solar eclipses on the ionosphere using SID monitor signatures. I reported some counterintuitive observations for the nightside ionosphere. This stimulated their interest. Deborah Scherrer has kindly sent me four papers listed on their website, but would normally cost \$9 to \$30 each to access. My activities over the next month or two will involve investing time in this effort. This is a good opportunity to further the association between amateur radio astronomers and the professional community. This is one vision I had talked about in the recent Signal newsletter(s). I have been convinced for years that innovative experiments and good science can be done with inexpensive equipment, keen attention to detail, and a good measure of resourcefulness.

*Radio Astronomy, ed. John C. Mannone, *Global Effect of Solar Eclipse on VLF Propagation*, John C. Mannone, Bill Lord, Melinda Lord, August/September 2008, p. 36-

John C. Mannone

TAO

Our long-delayed 15m wavelength Jove antenna party was held on Nov. 22 and everything went well. The idea was to build a twin-dipole phased antenna to detect signals from Jupiter and the sun on 15m (20 MHz).

Dick Castle and Bill Lord picked up parts and Dick assembled components. The poles and conduits were compliments of the college. Here are Dick, Bill, and Bill Seymour in an unplanned candid photo showing one of the complex steps:



The work party was very active. Here we have been joined by Melinda Lord and Misty Edwards and Jeff Haun.



Following a final candid photo, most of us adjourned to Gondolier for Italian goodies. This shows half of the double dipole in front of some of the TAO facilities. The system is very sturdy, and poles were not being held in place for the photo.



Thanks to everyone!

David Fields N4HBO

SOLWAY

Hacking the Ramsey FR1C receiver

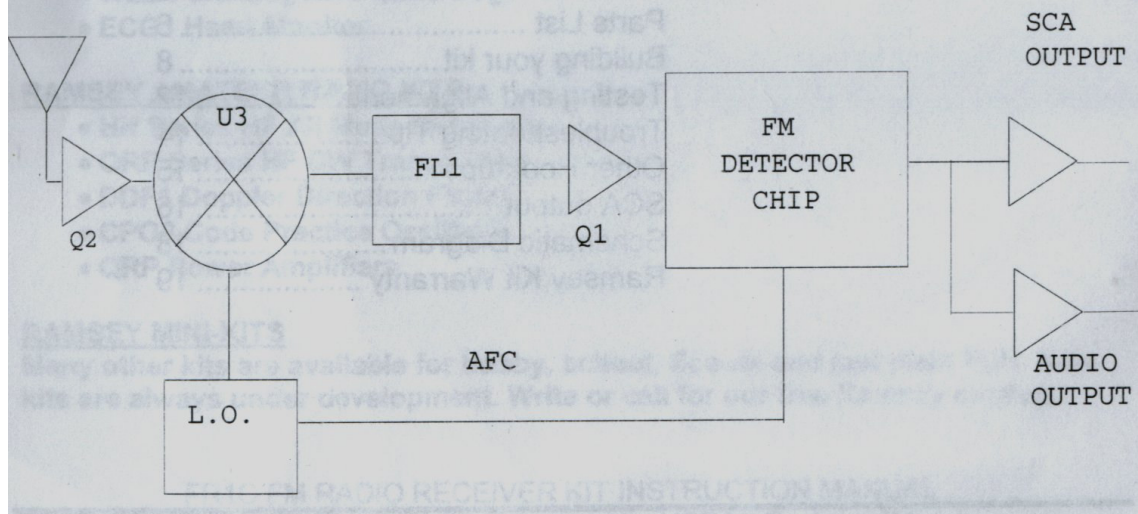
Bill Lord has purchased a Ramsey FR1C FM receiver kit. He did a beautiful job of assembling the kit. The receiver is fairly simple and comes with an excellent manual.

The receiver should be a good component for a meteor detection system, except that it has an automatic gain circuit (AGC). Bill and I wanted to hack it to disable this circuit and make the receiver more useful. The following description presents the intended purpose and shows the functional diagram. AGC functions are inside the FM detector chip, so for meteor detection, we need to capture the modulation envelope before it goes to the FM detector chip. Ideally we can still choose to sometimes listen to the FM signal to avoid local stations. Then for collecting data, we want to detect the envelope and route it to an external device (Skype, perhaps).

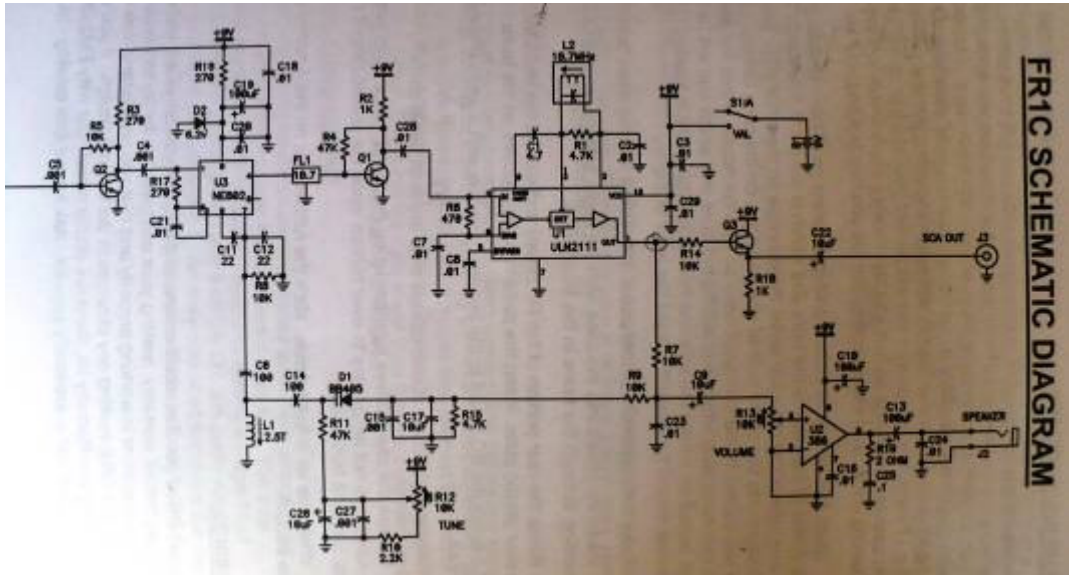
Your receiver kit is designed to receive wideband FM transmissions typical of standard FM broadcast stations, wireless mikes, telephone transmitters and the like. It was not designed for Narrow Band FM transmissions (NBFM) as you would find on police and fire transmitters, Ramsey offers a complete line of receivers for those services.

The FR1C demonstrates a whole lot of basic radio theory in one compact, simple circuit! Separate circuits are 'on-board' for all basic parts of a receiver, making it easy to visualize every function. The latest in IC circuitry is used which allows high performance without requiring exotic construction skills.

We think you'll agree that this little radio offers a lot of bang-for-the-buck, so let's get building!



The following figure shows the schematic of the receiver before modification:
Component U1 (center of diagram) is the FM detector chip.



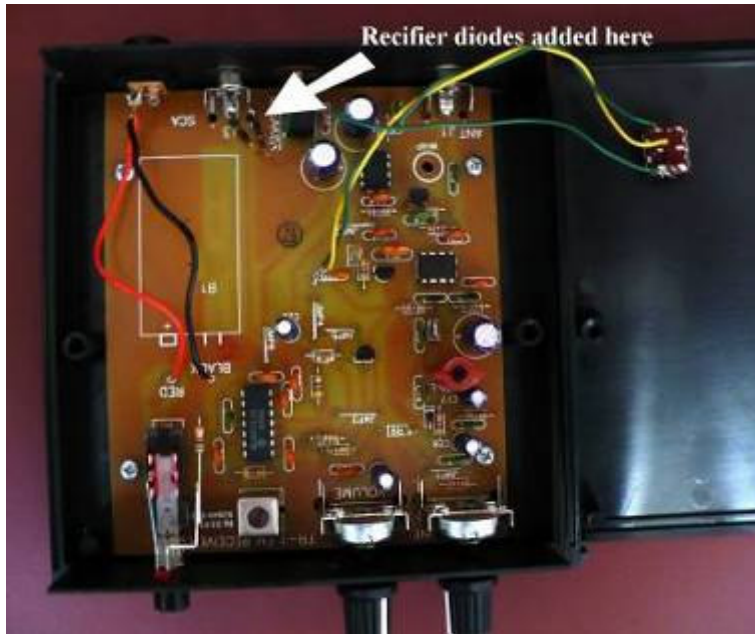
Modifications were made to add a switch to make the receiver function in either two modes. The first mode (tuning) lets the receiver operate normally. The user can select a dead space between local stations.

The second mode (selected by the operator using the switch) defeats the AGC by taking the RF envelope from the input to U1 and rectifying it, then feeding the output to the SCA connector. Simultaneously, the automatic frequency control (AFC) is defeated by opening the circuit just before R9. To accomplish both functions, a DPDT switch was used.

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The above figure shows the FR1C board with modifications (switch and diodes):

The following figure shows the completed (hacked) FR1C. In retrospect, the switch should have been mounted on the front or rear panel.



UNAM

Some of the latest work from Mexico was done by Stan Kurtz for the SARA Journal. This article begins as follows:

~ The Spatial Filtering Effect of Radio Interferometers ~ *By S. Kurtz (N9GKX) and D. Fields (N4HBO)*

Abstract: We discuss the origin and meaning of spatial filtering by interferometers, using the Very Large Array as an example. We demonstrate the effects of spatial filtering on a source with both small-scale and large-scale structures, and illustrate how to estimate the size sensitivity of an interferometer.

If one hangs around radio interferometrists for a while, one is sure to hear the phrase “an interferometer is a spatial filter.” But what does that mean? Even if one *doesn't* hang around with interferometrists, one may have wondered why it is that the Very Large Array (VLA), the powerful centimeter-wave radio interferometer operated by the National Radio Astronomy Observatory (Socorro, NM), has four distinct configurations. These configurations range from very compact (the D-configuration, or “D-array”, with a maximum separation between antennas of about a kilometer), to very extended (the A-configuration, or “A-array”, with a maximum separation between antennas of about 36 km).



Figure 1: The north arm of the VLA, seen in the D-configuration.
Image courtesy of NRAO/AUI.

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Etc.

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If you're a member of SARA then you have received an email about how to access the complete article. If you're not a member and want to read more, then contact Stan (s.kurtz@crya.unam.mx) or David (fieldsde@aol.com), or you might want to contact John (jcmannone@earthlink.net) and request a sample issue of the SARA Journal. The Journal is an excellent document for getting into the exciting possibilities of radio astronomy, and SARA membership is very affordable. See <http://radio-astronomy.org/> and click 'Membership' to find how to send your \$20/year dues.

Stan Kurtz (by DEF)

V. Radio Astronomy Basics

Fourier Analysis: An Important Tool in Radio Astronomy

(A Non-Mathematical Explanation)

Fourier Analysis is a mathematical process that is used to simplify the analysis of many types of raw data, such as complex wave forms received by radio telescopes/antennas. General functions are thereby converted to sums of simpler trigonometric functions. The attempt to understand functions by breaking them down into basic pieces that are easier to understand and deal with is one of the central themes of Fourier Analysis. The name comes from Joseph Fourier* who originally showed that representing a function by a trigonometric series greatly simplified the study of heat propagation in certain terrestrial industrial processes. As nearly all of the physical sciences have come to use this technique, the decomposing of a function into simpler pieces is called **analysis (or transform)**. The corresponding operation of rebuilding the function from these pieces is called **synthesis**. (In other words, each transform has a corresponding inverse process.)

Professional astronomers often must process signals, complex wave forms received from outer space, by using Fourier Analysis computer programs to isolate wanted and unwanted components. Also, cross correlation or co-alignment, of similar images from separate antennas in interferometry can be performed.

In other more down-to earth applications, the Fourier calculations are often built into the software of many common electronic devices. For example:

- In telephone dialing, the touch-tone signals for each telephone key when pressed, are each the sum of two separate tones (frequencies). Fourier Analysis can be used to separate (or analyze) the telephone signal, to reveal the two component tones—and therefore which button was pressed.
- In audio recording, unwanted frequencies (such as the hum from leakage of AC power into the signal) are removed. Also, the stereo subcarrier is removed from FM radio signals. And, musical sound tracks with vocals removed are created for later “voice-overs” at Karaoke Bars. (If those amateur singers who stand up to warble only knew that Joseph Fourier and his math make it all possible!)
- Digital radio reception with no superheterodyne (intermediate frequency) circuits, as in a modern cell phone or radio scanner.

*1768-1830; French mathematician, also an Egyptologist, who exerted a strong influence on mathematical physics through his publication, The Analytical Theory of Heat, in 1822.

Source: Wikipedia.org; the free on-line encyclopedia.

VI. Notable Quote

“The eternal mystery of the world is its comprehensibility...The fact that it is comprehensible is a miracle.”

--Albert Einstein 1879-1955; In Franklin Institute Journal,
March, 1936; “Physics and Reality”

VII. Article from Guest Contributor

Looking for Collaborators to Work on A Research Project For Dark Matter Detection

by Rodney Howe, <http://www.deep-space.org/news.shtml> Rev. November, 2008

Professional astronomers do not have time to do drift scans at 1420.406MHz (with perhaps the exception of Arecibo). It may also be that highly focused beam widths done by VLA and Arecibo at this frequency cause astronomers to overlook large quantities of HI clouds that inhabit the outer arms of our galaxy. There have been galactic surveys at 1420.406MHz of the HI clouds at narrow beam widths, but perhaps there needs to be a large beam width (0.7 to 3 degrees) spectral Doppler survey of the HI clouds. (Reich, Wolfgang, 2008, Galactic polarization surveys, Max-Planck-Institut fur Radioastronomie, Auf dem Hugel 69, D-53121 Bonn, Germany)
http://arxiv.org/PS_cache/astro-ph/pdf/0603/0603465v1.pdf

The Spectra Cyber (<http://www.jupiterspacestation.org/spectrometer/index.shtml>) spectrometer shows velocities of these clouds in the outer arms to vary considerably with respect to the Local Standard of Rest for our solar system. Spiral arms in the direction of Cygnus are coming toward us (and/or we're going toward them) at velocities in excess of 150km per second. However, clouds at the galactic center move very little either toward or away from us. It is likely that toward the center there is less HI gas and more visible matter (stars), but toward the extremities of the Milky Way there is more HI (cold dark matter) and fewer visible stars.

If there were cold 'dark matter' in the outer arms of our Milky Way, it might satisfy professional astronomer's reasoning why stars in the outer arms have not flown off into intergalactic space. It seems the only way the outer arms can be moving as fast as they are, and still remain part of the galaxy, is if there is dark matter (non visible mass) holding everything together. There are more HI clouds looking toward the outer arms than looking toward the galactic center (spectral line broadening), although they are less dense and much colder than the inner galactic HI clouds. The hypothesis might be that because we are located in the second/third spiral arm, and given that there are more HI clouds toward the galactic extremities, it may be that the HI clouds represent a form of cold 'dark matter' in the Milky Way.

One way we might test this hypothesis is to measure the area under polarized 'spectral curves' as we do drift scans of the inner and outer galactic arms with polarized feed horns.

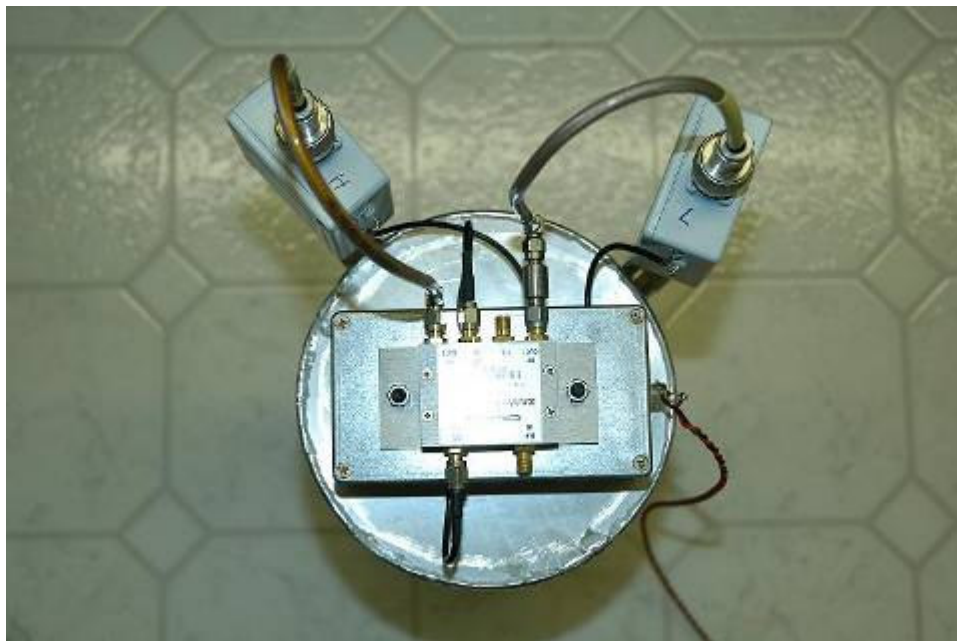
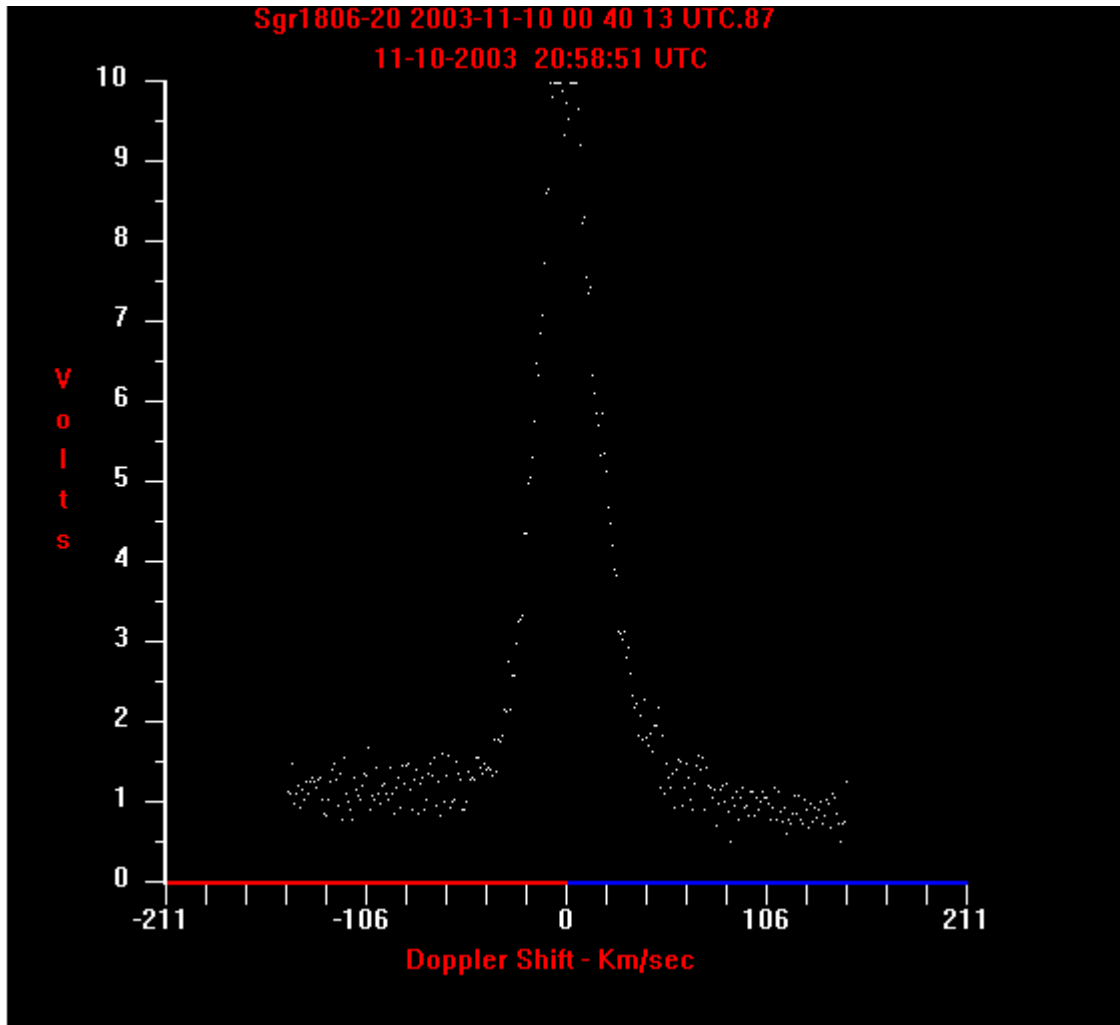


Figure 1, Polarized 1.420 GHz feed horn with RF switch (built by Carl Lyster)

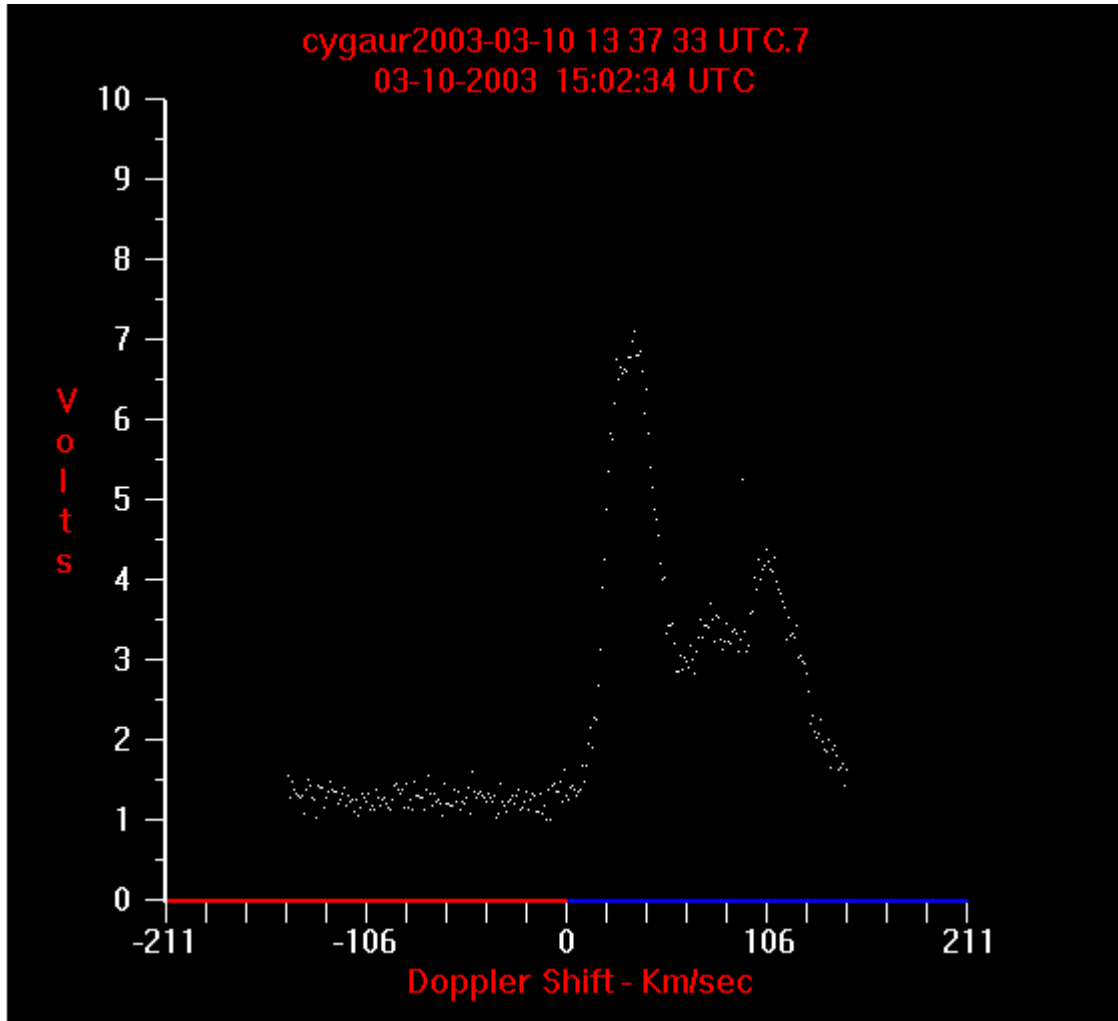
Data from the center of the galaxy show a narrow peak of unmoving HI clouds. This may represent less cold dark matter toward the center of the galaxy as well as our general motion neither toward nor away from the center. Whereas data from the outer arms show a relative motion toward us, as well as a broader spectral curve, since we're looking through multiple galactic arms.

<http://www.atlasoftheuniverse.com/galaxy.html>



This Figure 2 above shows a steep but narrow curve. There is neither a movement toward nor away from our position, which is about 2/3 the distance from the galactic center. The combination of a narrow peak and little movement might be an indication of less cold dark matter.

But as we look out toward the distant arms in the direction of Cygnus many of the HI clouds, in at least 3 outer galactic arms, are coming toward our Local Standard of Rest (solar system motion). There is also a broadening of the 'spectral curve' because of the large quantity of HI clouds in these multiple arms. But, are there differences in the magnetic structure between the outer and the inner galactic arms, which can help determine the temperature and quantity of HI in these outer arms?



In Figure 3, both the larger area under the curve and the velocity of approaching clouds might be an indication a larger quantity of HI clouds and perhaps an indication of cold 'dark matter'. If we find a significant difference in area and velocity and magnetic structure we could build an index that might correlate with other data from other surveys such as that of A.J. Romanowsky et.al., (2003, Vol 301, Science) who suggests the only way to determine the motion of elliptical galaxies is to look at the planetary nebulas and their OIII emissions, i.e. SNR nebulas exciting, in the UV, the blown out clouds from progenitor stars. They think they've found a connection with elliptical galaxies that have little or no dark matter. Where a lack of dark matter, apparently, maintains Keplerian motions of the elliptical galaxy's outer arms. Everything seems to obey standard Newtonian motions and Kepler's laws for these elliptical galaxies. But that seems not to be the case for large spirals like the Milky Way.

This research proposal makes some assumptions about what cold 'dark matter' is and how we might measure it. Here are a few of those assumptions:

1. Dark matter may be made up of inter-stellar space that is very (to extremely) cold. Perhaps as cold as the cosmic microwave background (CMB). The CMB is around 2.69K to 2.73K.
2. Cold dark matter may reflect a behavior similar to a super fluid phase, in that it acquires a non-classical rotational inertia (NCRI), and can be detected by a

magnetic polarized structure that is different than the polarized structure in the inner galactic arms.

3. If Hydrogen (cold dark matter) in the inter-stellar medium (ISM) changes to a super fluid phase then it might satisfy the Onsager-Feynman relation. (R.P. Feynman, 'Progress in Low Temperature Physics' (North-Holland, Amsterdam, 1955) chap. 2.) Where $2\pi R * v_s = (h/m) * n$, v_s is the super flow velocity, h is Planck's constant, m is the mass of the Hydrogen [in this case in a column of the gas], and the integer n is the angular momentum of the entire column looking down the galactic arm.
4. The velocity of outer galactic arms are on the same order of magnitude as the critical velocity v_c which might be measured as the velocity of the non-classical rotational inertia (NCRI). There is a temperature dependence of ρ_{oc}/ρ at different pressures that is NCRI curves might be measured at the lowest velocities while looking toward the galactic center (ρ_{oc}), and compared to the higher velocities toward the galactic extremities, i.e. some kind of index.
5. This requires us to estimate, to the best we can, the temperature and velocity of the galactic center clouds, versus the temperature and velocity of the outer galactic clouds, as well as their relative motions (velocities). Then compare these velocity/temperature measures with what they should be in a classical rotational inertia frame, which would imply higher temperatures. Mapping the inner and outer arms with polarized feed horns might help detect the super fluid phase (cold temperatures) in the outer arms compared to the magnetic structure of the inner warmer galactic arms.

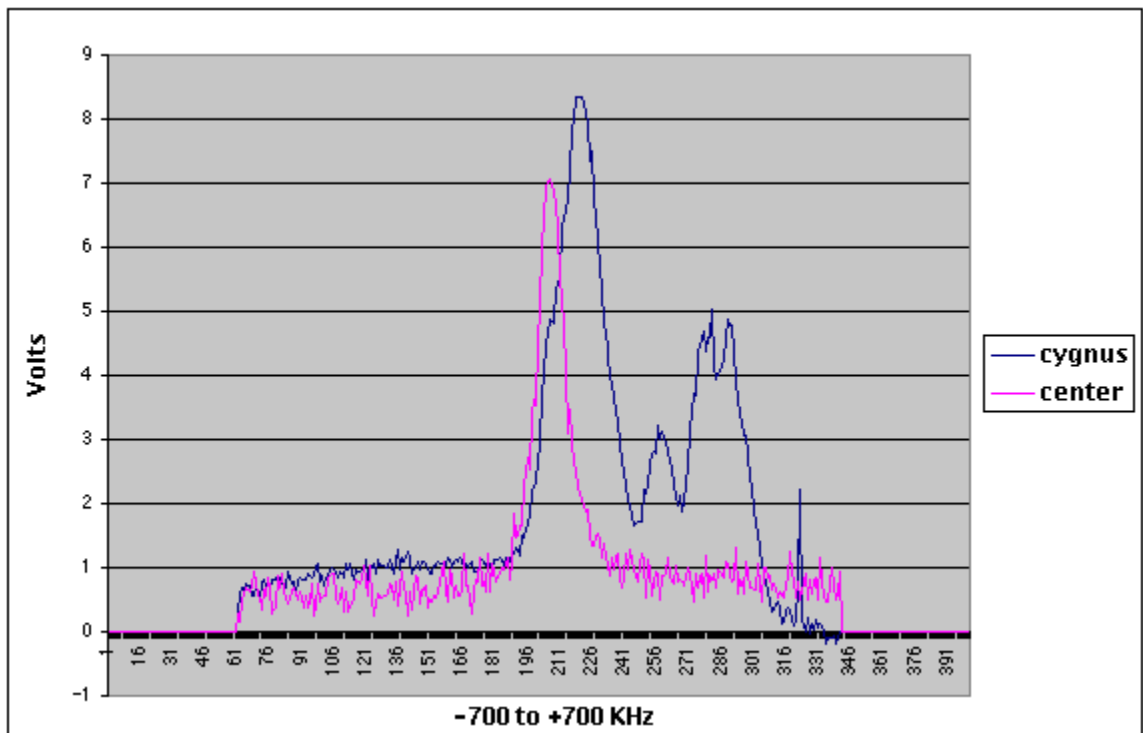


Figure 4 is an overlay of the HI spectra for the center of the galaxy (red) and looking at the Cygnus arm toward the outer galactic arms (blue), with 3 distinct humps.

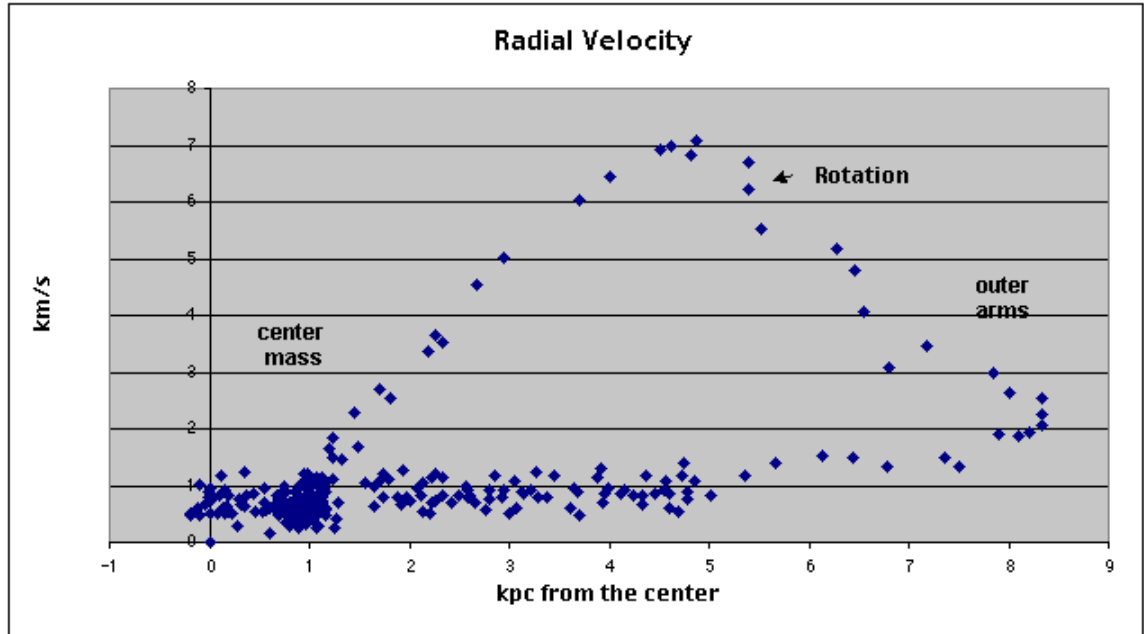


Figure 5 is a model of how the mass in the Milky Way would be distributed, which would cause non-Keplerian radial velocities. If the outer arms have a different magnetic structure for the cold HI clouds, which might be detectable with small amateur radio dishes, then it may be possible to measure these structural differences with polarized detectors, and make some inferences about the extent of the HI clouds, and their temperatures, and their influence in the gravitational pull they have on stars in the outer galactic arms.

If there are amateur astronomers who might like to collaborate on a research project to map the inner and outer galactic arms with 1.420 GHz polarized feed horns please contact me at ahowe@frii.com

References cited:

A.J. Romanowsky et.al., (2003, Vol 301, Science)

R.P. Feynman, 1955, 'Progress in Low Temperature Physics', North-Holland, Amsterdam, 1955, chap. 2.

Reich, Wolfgang, 2008, Galactic polarization surveys, Max-Planck-Institut fur Radioastronomie, Auf dem Hugel 69, D-53121 Bonn, Germany, http://arxiv.org/PS_cache/astro-ph/pdf/0603/0603465v1.pdf

Biographical Sketch Submitted from Contributing Author Rodney Howe

I woke up with Rip Van Winkle in Sleepy Hollow, New York about 60 years ago. When I was ten I built a one tube $\frac{1}{4}$ watt transmitter. I tuned it to some low frequency on the AM band and set an old radio in the corner and called the family dog. I laughed really hard at that, and have been building short wave and long wave radios since. Well, until I went to college. However, I could not make a living teaching high school, so I went back and got a degree in computer programming and a master's degree in Geographic Information Systems. I now make maps for the federal government at the Centers for Epidemiology and Animal Health (CEAH), USDA, Animal Plant Health Inspection Service, Veterinary Services.

I've been a member of SARA since 2000, and am a board member at large, out in Fort Collins, CO. I've been learning all I can about astronomy, both radio and optical; however I still record data with an old Gyrator receiver, listening to the naval station in La Moure, ND, at 25.2 kHz. On December, 27, 2004 I detected the super flare from SGR1806-20, and published this article in the Open European Journal of Variable Stars:

<http://var.astro.cz/oejv/issues/oejv0022.pdf>

Hopefully this article in TAOSON will inspire folks to want to collaborate with our group out here in Longmont Colorado: <http://www.deep-space.org/index.shtml>
Perhaps build HI spectral line receivers with polarized feed horns and perhaps do some science on the cold dark matter problem.

